CLAIMS:

1. A refrigeration cycle apparatus, comprising:

a compressor having a rotary shaft, wherein the rotary shaft is rotated by an external drive source, wherein, when the rotary shaft is rotated, the compressor increases the pressure of refrigerant;

a radiator for cooling refrigerant the pressure of which has been increased by the compressor;

an expansion device, wherein the expansion device decompresses and expands refrigerant that has been cooled by the radiator, and then discharges the refrigerant, and wherein the expansion device generates power using the decompression and expansion and transmits the power to the rotary shaft;

an evaporator, wherein the evaporator heats refrigerant that has been decompressed and expanded by the expansion device; and

a variable discharge rate mechanism, which is capable of changing the discharge rate of the expansion device per rotation of the rotary shaft.

2. The refrigeration cycle apparatus according to claim 1, wherein the expansion device has a rotary shaft, wherein the variable discharge rate mechanism is a variable-speed mechanism located between the rotary shaft of the compressor and the rotary shaft of the expansion device, and wherein the variable-speed mechanism changes the ratio of rotation speed between the rotary shaft of the compressor and the rotary shaft of the expansion device.

3. The refrigeration cycle apparatus according to claim 2, wherein the variable-speed mechanism is a planetary gear train.

4. The refrigeration cycle apparatus according to claim

1, wherein the variable discharge rate mechanism is a variable displacement mechanism, wherein the variable displacement mechanism is incorporated in the expansion device and is capable of changing the displacement of the expansion device.

5. The refrigeration cycle apparatus according to claim 4, wherein the variable displacement mechanism includes a piston, a swash plate that converts rotation of the rotary shaft into reciprocation of the piston, and an actuator that changes the inclination angle of the swash plate, and wherein the displacement of the expansion device is changed according to the inclination angle of the swash plate.

6. The refrigeration cycle apparatus according to claim 1, further comprising:

a refrigerant circulation passage that includes the radiator, the evaporator, the compressor, and the expansion device;

a detection device that detects the pressure at an arbitrary section in the refrigerant circulation passage; and

a controller that controls the variable discharge rate mechanism such that the difference between a detection value of the detection device and a predetermined target value is eliminated.

7. The refrigeration cycle apparatus according to claim 6, wherein the detection device detects the pressure at a section of the refrigerant circulation passage in the vicinity of an outlet of the radiator.

8. The refrigeration cycle apparatus according to claim 6, wherein the controller determines the target value based on the temperature of the refrigerant at an outlet of the radiator.

9. The refrigeration cycle apparatus according to claim 1, wherein the refrigerant is carbon dioxide.

10. The refrigeration cycle apparatus according to claim 1, wherein the apparatus is mounted on a vehicle, and wherein the external drive source is a drive source of the vehicle.

11. The refrigeration cycle apparatus according to claim 1, wherein the compressor, the expansion device, and the variable discharge rate mechanism are integrated.

12. The refrigeration cycle apparatus according to claim 11, wherein the expansion device and the variable discharge rate mechanism are incorporated in a housing of the compressor.

13. A unit incorporated in a refrigeration cycle apparatus, wherein the refrigeration cycle apparatus includes a radiator for cooling introduced refrigerant, and an evaporator for heating introduced refrigerant, the unit comprising:

a compressor having a rotary shaft, wherein the rotary shaft is rotated by an external drive source, wherein, when the rotary shaft is rotated, the compressor increases the pressure of refrigerant and sends the refrigerant to the radiator;

an expansion device, wherein the expansion device decompresses and expands refrigerant sent from the radiator, and discharges the refrigerant to the evaporator, and wherein the expansion device generates power using the decompression and expansion and transmits the power to the rotary shaft; and

a variable discharge rate mechanism, wherein the variable discharge rate mechanism changes the discharge rate of the expansion device per rotation of the rotary shaft, and wherein the compressor, the expansion device, and the variable

discharge rate mechanism are integrated.

14. The unit according to claim 13, wherein the expansion device and the variable discharge rate mechanism are incorporated in a housing of the compressor.

15. The unit according to claim 13, wherein the expansion device has a rotary shaft, wherein the variable discharge rate mechanism is a variable-speed mechanism located between the rotary shaft of the compressor and the rotary shaft of the expansion device, and wherein the variable-speed mechanism changes the ratio of rotation speed between the rotary shaft of the compressor and the rotary shaft of the expansion device.

16. The unit according to claim 13, wherein the variable-speed mechanism is a planetary gear train.

17. The unit according to claim 13, wherein the variable discharge rate mechanism is a variable displacement mechanism, wherein the variable displacement mechanism is incorporated in the expansion device and is capable of changing the displacement of the expansion device.

18. The unit according to claim 17, wherein the variable displacement mechanism includes a piston, a swash plate that converts rotation of the rotary shaft into reciprocation of the piston, and an actuator that changes the inclination angle of the swash plate, and wherein the displacement of the expansion device is changed according to the inclination angle of the swash plate.

19. The unit according to claim 13, wherein the refrigerant is carbon dioxide.